

they all died within a short period of admission to hospital, the tumours being verified post-mortem.

In summarizing these findings it would appear that abnormal mental phenomena may be present in certain cases of cerebral tumour without definite localizing signs. In this series no physical signs were apparent in seventeen per cent., and in an additional forty per cent. these signs were vague and indefinite.

Mental symptoms are much more frequently associated with supratentorial growths, especially when such involve the left side.

The form of the symptoms depends to a greater extent on the type of personality and the rate of growth of the tumour, rather than upon its location.

In slow-growing tumours changes in the personality are conspicuous; there appears to be, as it were, a release phenomenon. In rapidly-growing tumours, disturbances in the intellectual functions are marked and personality changes slight. In such cases, however, the mental changes may be indistinguishable from those the result of other organic lesions.

It would appear that no mental syndrome can be associated with a lesion of any one area of the brain.

The Vitamin C Content of Apples, and Dietary Requirements of this Vitamin

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A RECENT statement by Professor V. H. Mottram¹ to the effect that the Bramley's Seedling apple raw or cooked is an excellent source of vitamin C, has stimulated this study of the literature on the subject.

The Bramley's Seedling apple was first raised by a Mr. Bramley of Nottinghamshire in 1876. It is one of the best cooking apples, is famed for its keeping qualities, and is a greatly prized variety in Northern Ireland, where the climate suits it well—so much so that in area of cultivation it equals all other varieties put together, and accounts for about three-quarters of the total quantity of apples exported from the Six Counties (approximate proportions given by the Ministry of Agriculture).

Apples are not commonly credited with a very significant vitamin C content. Sherman and Smith, 1931,² give as their finding that fresh raw apples in general are half as rich in vitamin C as bananas, bananas being a third as rich as oranges. In 1930, however, Bracewell, Hoyle, and Zilva³ had conducted a series of experiments with different varieties of home and colonial apples, under the Medical Research Council, and had found that one cooking apple in particular (the Bramley's Seedling) had an especially high antiscorbutic potency, and that there was no significant loss of potency when the apple was cooked in its skin for fifty minutes in a slow oven. These experiments were carried out in the accepted way—guinea-pigs of 300 grams weight being fed on a standard scurvy-producing diet and the

smallest amount of apple-flesh determined which, when added to the daily ration, proved regularly capable of preventing any sign of scurvy developing during the test period of ninety days. The minimum protective dose (m.p.d.) of the Bramley's Seedling was three grams. The Dabinett came next of the varieties tested, but was three to four times less potent, and the Cox's Orange Pippin was six to seven times less potent. The effect of storage on the apples was also investigated : there was a negligible loss of potency in the Bramley's Seedling after three months' storage at 1° C. "Gas storage" caused a slightly greater but still negligible loss, while common storage permitted slight destruction of vitamin. The loss was greater in each case with Cox's Orange Pippin.

Further work by Zilva and others in 1932 and 1933,^{4 5} has confirmed these findings. It seems that a high antiscorbutic potency is related to a low nitrogen content in the apple, and it is suggested that the Bramley's Seedling possesses almost the maximum potency possible in the apple. Similar work has been done in America by Batchelder, 1934,⁶ with especial reference to the Delicious apple which is widely grown; it is not, however, very potent.

The following list of the minimum protective doses of a number of different varieties of apple is taken partly from the English and partly from the American figures, and shows the very wide variations in antiscorbutic potency.

| Variety of apple | | Country | Minimum protective dose in grams |
|----------------------|-------|---------|----------------------------------|
| Bramley's Seedling | - - | England | 3 |
| Baldwin | - - - | America | 4 |
| Baldwin | - - - | England | 15 |
| Belle de Boskoop | - - | England | 5 |
| Blenheim Orange | - - | England | 10-20 |
| Cox's Orange Pippin | - - | England | 20 or more |
| Dabinett | - - - | England | 10 |
| Delicious | - - - | America | 17-25 |
| Jonathan | - - - | America | 20-25 |
| King Edward | - - | England | 20 or more |
| Lane's Prince Albert | - - | England | 10 |
| McIntosh | - - - | America | 20 or more |
| Newton Wonder | - - | England | 10 |
| Northern Spy | - - - | America | 4-5 |
| Winesap | - - - | America | 10 |
| Worcester Permain | - - | England | 20 |

Such findings do not detract from the value of choice and attractive "eating" apples, which usually form part of a well-mixed diet, but the properties of the Bramley's Seedling in this country are of considerable interest and worth.

Before the figures, which refer to guinea-pigs, can be of much use in practice they must be translated into amounts applicable to man, and compared with similar figures for other common foodstuffs containing vitamin C.

We know now that vitamin C is a crystalline substance to which the name

ascorbic acid has been given. It is capable of being synthesized, and quantitatively titrated by virtue of its reducing powers. The human body apparently cannot manufacture it, although chicks and various animals and plants have this power. In the human a proportion of any ingested ascorbic acid is rapidly excreted in the urine if there is no previous deficiency, and as a result of experiments investigating the intake of definite quantities and the corresponding excretion, a minimal optimum daily intake has been determined. For an adult of ten stones weight this amounts to 25 mg. ascorbic acid : it corresponds to an excretion of about 14 mg. per day.⁷

A rough test for detecting deficient excretion (and therefore deficiency) of ascorbic acid can readily be carried out, after a test dose, by using indicator tablets of dichlorophenol-indophenol, obtainable from Roche Products Ltd. This test is quite suitable for general practice.

The daily allowance of 25 mg. ascorbic acid is equivalent to 500 international units of vitamin C, one unit being 0.05 mg. ascorbic acid, which is approximately a tenth of the minimum protective dose for a guinea-pig on a scurvy-producing diet. This 500-unit standard for minimal optimum intake is not a universally recognized one. A recent American public health year book quoted by Bridges, 1937,⁸ puts an adult's requirements at 300 units, whereas Mottram, 1937,¹ gives 600 units.

However, the 25 mg. or 500-unit standard seems to have a fair amount of weight behind it as a minimum allowance, and it will be used for the following table.

| Foodstuff | Minimum protective dose (guinea-pig) | Units of vitamin C per oz. | Amount needed to provide a minimum allowance of 500 units | Amount needed, approximately, to provide the 500 units |
|--------------------------------------|--------------------------------------|----------------------------|---|--|
| *Orange juice - - | 1.5 c.c. | 200 | 2½ oz. | small juicy orange |
| Bramley's Seedling apple - - - | 3-5 gm. | 106-64 | 5½-8½ oz. | 1-1½ apples |
| Lettuce - - - | 1-2 gm. | 320-160 | 1½-3½ oz. | 2-4 large leaves |
| Strawberries - - | 2-5 gm. | 160-64 | 3½-8½ oz. | small to large helping |
| Tomato juice (fresh or tinned) - - - | 3 c.c. | 100 | 5 oz. | 3-5 tomatoes (?) |
| New potato (boiled 15 mins.) - - - | 4 gm. | 80 | 7 oz. | 1 large potato (new) |
| Banana - - - | 5-10 gm. | 64-32 | 8½-oz.-1 lb. 1½ oz. | 2-4 bananas |
| Green peas (boiled 15 mins.) - - - | 5 gm. | 64 | 8½ oz. | very large helping |
| Potato (boiled 15 mins.) | 10 gm. | 32 | 1 lb. 1½ oz. | full meal of potato (!) |
| Pear - - - | 10-15 gm. | 31-21 | 1 lb. 1oz.-1½ lb. | 4-5 pears |
| Apple (average) raw - | 15-20 gm. | 21-16 | 1½ lb.-2½ lb. | 5-8 apples |
| Grapes - - - | over 20 gm. | 16 | over 2½ lb. | over 2½ lb. |
| Milk (summer pasture) | 50 c.c. | 6 | 4½ pints | 2 quarts |
| Milk (boiled and quickly cooled) - | 100 c.c. | 3 | 8½ pints | 4 quarts |

* Orange juice is not always so potent ; Mottram's figures amount to 1½-4½ oz. for 500 units, which approximate to .75-2.75 for the m.p.d.

The minimum protective dose figures for a number of common foodstuffs have been obtained for the most part from Sherman and Smith's "The Vitamins," 1931, where a full bibliography of all the investigations is given. There is often considerable variation in results, and in the table the range of the m.p.d. is given rather than an average figure. Following from the m.p.d., which equals ten units for a guinea-pig, the number of units per ounce is calculated, and along with this is tabulated the amount of foodstuff which will provide the minimal optimum daily allowance of vitamin C for an average adult weighing ten stones, i.e., 500 units. The orange is placed first, being the usual standard of comparison, and it will be seen that the Bramley's Seedling apple approaches the orange in antiscorbutic activity.

It should be added that lemon juice has approximately the same potency as orange juice, while grapefruit juice is not much more than half as potent. The Bramley's Seedling variety has been mentioned alone from among the various varieties of apples, but at least one American apple (the Northern Spy) is not far short of its potency. Gooseberries and raspberries are of the same order as strawberries: the cooking of these fruits reduces their vitamin C content by about half, and home bottling is likely to destroy it altogether. Efficient canning is not in general destructive of vitamin C to a large extent.

Cooked brussels sprouts are quite a good source of the vitamin, 500 units being contained in 3-3½ oz., and cooked spinach is also good, the figures being 1½-6½ oz. (Mottram).¹ Soda should not be added to the water used for cooking, as alkalinity favours destruction of vitamin C. In connection with the figures for milk it must be noted that human milk is five or six times more potent than cow's milk, and during pregnancy and lactation a woman should have twice the usual allowance of the vitamin. An infant requires about 100 units per day.

It is interesting to know that when necessary a very efficient antiscorbutic food can be made by germinating beans for forty-eight hours at 60-70° C., and then cooking them for ten minutes; four ounces of dry beans are thereby made equivalent to four ounces of orange juice (Wiltshire, 1918, quoted by Sherman and Smith).

Comparative figures such as have been given should be of use in practice, and this usefulness may increase when more is known about the harmful effects of a sub-scurvy diet.

Ascorbic acid is now available in the form of tablets, but most people will probably prefer to continue to take it incorporated in their food in the ordinary way. We must be critical, however, towards the many indications suggested for the prescribing of the tablets, even though it is tempting to look for a cure in vague unhealthy conditions by correcting a vitamin C deficiency which may be common enough.

In all infective and febrile conditions and in rheumatism there is certainly the backing of general experience for giving fairly large amounts of orange juice, etc. Ascorbic acid has been shown to be very rapidly used up in such conditions,^{9 10} and should therefore be provided lavishly; but there is possibly more benefit in the natural fruit with its organic acids than there would be with pure ascorbic acid.

It is reasonable to believe, too, that patients on ulcer diets suffer from poor healing

of wounds and other disabilities owing to a deficient intake of vitamin C,¹¹ and this should be corrected as found suitable.

In unhealthy conditions of the gums, which undoubtedly respond well to large amounts of orange juice, the tablets of ascorbic acid might be an improvement on the fruit in the acute stages.

It is noteworthy that the actual structure of teeth is influenced by vitamin C intake. Many workers between 1919 and 1929² found that in guinea-pigs on a scurvy-producing diet the teeth were the first part of the system to be affected. After six or seven days profound microscopical changes in the structure of the teeth could be detected, and these changes could be corrected rapidly, i.e., in forty-eight hours, by the addition of an antiscorbutic. By alternating deficient with normal diet it was possible to produce distinct markings on the enamel of the teeth. It has also been found that massive doses of vitamin C have a very beneficial effect on human teeth in cases of caries and pyorrhœa (Hanke, 1929²). So that it would seem wise to make sure that children have a liberal supply of the vitamin.

To conclude with perhaps the most remarkable claim for ascorbic acid, it is known that the suprarenals contain a high concentration of the acid,¹² and it has been reported that large doses of it have similar effects on the body to those of the cortical hormone.⁸ Whether this will be satisfactorily confirmed or not remains to be seen.

There is no doubt, however, that for many reasons an especially liberal allowance of vitamin C in the diet may be valuable, and it is well to know that such an allowance can be made up very pleasantly with coddled Bramley's Seedling apples when such a food is acceptable. The cost of these apples is about the same as that of oranges for equivalent amounts.

SUMMARY.

An account of the literature on the remarkably high antiscorbutic potency of the Bramley's Seedling apple raw or cooked is given. Figures for this and other foods are reduced to household terms for the amounts necessary to provide a daily intake of 500 international units of vitamin C or 25 mg. ascorbic acid. References to the possible values of vitamin C treatment are given in conclusion.

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